MONTHLY LETTER OF THE BUREAU OF ENTOMOLOGY
UNITED STATES DEPARTMENT OF AGRICULTURE

Number 213 **Activities for December** **January, 1932**
(Not for Publication)

STORED PRODUCT INSECTS

H. C. Donohoe, Fresno, Calif., finds that the dried fruit beetle (Carpophilus hemipterus L.) sometimes hibernates in unexpected places. Perez Simmons says: "In the course of a personal collecting trip on December 6, Mr. Donohoe observed 25 to 30 adult dried fruit beetles hibernating in the soft, decaying wood of a cottonwood stump, in the vicinity of Skagg's Bridge, 18 miles west of Fresno on the San Joaquin River. Hibernation of the adult apart from decaying fruit was not previously known."

Mr. Simmons also reports: "Two experimental fumigations of Alicante raisins were made late in November under covers of waterproofed canvas, using dosage rates of 15 and 17 pounds of liquid SO_2 per 1,000 cubic feet. Complete kills of dried fruit insects were obtained only in test boxes placed in raisins at the bottom of the piles of sweat boxes. Exposures were 18 3/4 and 71 1/2 hours; temperatures were for the most part below 50° F. Analyses of the fumigated raisins * * * were reported to have shown 33 and 77 parts of SO_2 per million, the moisture content of the samples being 16.8 per cent and 22 per cent. * * * The evidence secured to date indicates that sulphur dioxide is an excellent fumigant for use during cold weather."

The revival of insects fumigated in a vacuum with carbon disulphide at low temperatures is reported by Mr. Simmons: "On November 24 a 2-hour test fumigation, made at the Fresno plant of the California Peach and Fig Growers Association, using CS_2 blanketed with nitrogen, gave incomplete kills. The temperature at the beginning was 49° F. All insects appeared dead upon removal, but revivals of saw-toothed grain beetle adults and of Ephestia larvae began, respectively, after 3 and 4 days. One Ephestia larva revived after 9 days."

On December 15 Merced County, Calif., adopted "An ordinance declaring Endosepsis, Dried Fruit Beetle, Vinegar Fly, and Fruit Moth to be pests, declaring certain things public nuisances by reason of their effect in propagating and disseminating Endosepsis, Dried Fruit Beetle, Vinegar Fly, and Fruit Moth, and regulating the business or industry of producing figs by providing means of abating such plant diseases and insects."

C. K. Fisher, Mcdesto, Calif., states that "The month of December has been spent almost entirely in the examination of warehouse bean samples (to determine the need of fumigation of the crop concerned). To December 28, 3,715 samples have been collected and all examined once for weevil infestation. Of this number 1,416 were found to be infested, giving a percentage of 38.1 per cent infested." Mr. Fisher also reports that 12 fumigatoria in bean warehouses have been tested for their efficiency. These fumigatoria are all used for fumigating consignments of beans delivered at the warehouses by the farmers and found by inspection to be weevily. The results ranged from 57.6 to 100 per cent kill.

Tom Brindley, Moscow, Idaho, submits "tables to show the results of a study of harvest loss and its relation to pea weevil infestation on 20 farms in the vicinity of Moscow, Idaho. The loss per acre was determined by picking up all of the peas lost on plots 10 feet square in representative parts of each field. * * * The maximum loss per acre was found to be 50 per cent of the possible yield on a field harvested by the combine method, in which the peas actually harvested averaged 690 pounds per acre. The minimum loss was 7 per cent on a combined field which yielded 1,428 pounds per acre. The average loss for the 20 fields was 33 per cent of the possible yield. On 11 fields harvested by the combine method the average loss per acre was 29 per cent; on 6 fields harvested by the stationary thresher 32 per cent were lost; while on 3 fields harvested by other methods the loss was 38 per cent. It is evident from these figures that the combine method harvests more peas than the other methods."

Mr. Brindley submits tables and a graph showing the relation of the location of the pea pod on the vine to infestation by the weevil. He says: "The average infestation at the base of the vine, as shown in the summary, was 62.4 per cent, while at the top of the vine it was 19.7 per cent. This point seems to me to have a great deal of bearing on the weevil problem, for in faulty harvesting the tops of the vines are often the only parts harvested, while the lower pods which are the most heavily infested are allowed to remain in the field, permitting the weevils to escape and find good hibernating quarters."

Mr. Brindley has also made a study of the relation of hills and valleys to weevil infestation, and states: "I have found it to be almost invariably true that high points are less infested than low points. Hills along the border may have a lower infestation than valleys in the center of fields if a moderate infestation is present."

On November 30 E. M. Livingstone, of the cured-tobacco investigations, Richmond, Va., completed 174 egg-to-adult rearings of the parasite Microbracon hebetor (Say), an active parasite of Ephestia elutella in certain tobacco warehouses. Concerning these rearings W. D. Reed reports: "The developmental periods average as follows:

Incubation period	2.3 days
Larval period	9.4 days
Pupal period	7.4 days
Egg-to-adult period	19.1 days

"These rearings were made in a heated room at the laboratory at an average temperature of 75° F. All of the parasites were reared on well-grown Ephestia elutella larvae. The numbers that developed on one host larva ranged from one to nine."

Early in December A. W. Morrill, jr., began a series of experiments at Richmond to gauge the degree of cold necessary to control larvae of the tobacco beetle by freezing. He placed well-grown larvae in pill boxes having a volume of 2.35 cubic inches and filled with pipe tobacco, snuff, or pulverized fine-cured tobacco. It was found that a temperature of -4° C. gave only 10 per cent kill in a 24-hour exposure, whereas a temperature of -8° C. resulted in 100 per cent kill after the same exposure.

TOXICOLOGY AND PHYSIOLOGY OF INSECTS

F. L. Campbell and W. N. Sullivan, Takoma Park, Md., are continuing their experiments to determine the toxicity of rotenone to house flies. Dr. Campbell reports: "Fifteen groups of 50 flies each were treated with a 1-to-5,000 solution of rotenone in acetone. * * * Most of the flies that were not normal (moribund) at the end of 24 hours after the application of the fog died during the next 24 hours. The results may therefore be summarized by giving the average mortality at the end of 48 hours, which was 42.9 per cent. The mortality in individual tests ranged from 10 per cent to 70 per cent in 48 hours, a greater variability than would be expected under the uniform method of application of the poison. This variability can probably be reduced by selection of flies of the same sex and those that have taken plenty of milk on the day of the test. As a check, 50 flies were treated with acetone on five occasions. The mortality ranged from 0 to 8 per cent in 48 hours. The mortality of flies treated with rotenone suspended in water at 1-to-5,000 was no greater than that in the checks."

D. E. Fink, Takoma Park, devoted the month of December to the project, "Metabolic Activity during Hibernation." He says: "The average weight of hibernating larvae of Carpocapsa pomonella L. during the first half of the month was 44.67 milligrams and during the latter half 41.75 milligrams, or a loss in weight of 6 per cent. The water content remained constant during the month and averaged 59 per cent. The total fat content (ether extract) averaged 19 per cent of wet weight. A larva that weighed 44.92 milligrams contained 9.42 milligrams of fat, or 20 per cent of wet weight. It also contained 0.232 milligram of sugar as glucose, or 0.5 per cent, and 0.53 milligram of glycogen by weight, or 0.45 milligram determined as glucose, which is equivalent to 1 per cent glycogen. Ancylis comptana Froel., on the other hand, averaged in weight 12.93 milligrams during the first half of the month, and 10.90 milligrams during the latter half, or a loss of weight of 15 per cent. The water content was 71 per cent during the first half of the month and 69 per cent during the latter half. A larva that averaged 12.665 milligrams in weight contained 1.105 milligrams of fat, or 8 per cent of wet

weight, and contained 0.138 milligram of sugar as glucose, or 1 per cent. A larva that weighed 13.20 milligrams contained 0.43 milligram of glycogen by weight, or 3 per cent, and 0.3744 milligram when determined as glucose, or 2 per cent. A comparison of the two species, therefore, shows that C. pomonella weighs about four times as much as A. comptana but its water content is 11 per cent less and its fat content 11 per cent more. Its sugar content as glucose is 0.5 per cent less and its glycogen content 1 per cent less than in A. comptana."

BEE CULTURE

To present the life of the bee adequately and to show the part it plays in honey and wax production and in pollination, James I. Hambleton, in charge of the Bee Culture Laboratory, Somerset, Md., in cooperation with the Motion Picture Laboratory of the Department, began work two years ago on a motion picture film. This film, "The Realm of the Honeybee," has now been completed and was shown to Bureau workers in December. Nearly all of the scenes were taken at the Bee Culture Laboratory at Somerset, Md. Those on the use of honey in cooking, however, were taken in the experimental kitchens of the Bureau of Home Economics, and the scenes on pollination were taken in commercial orchards in upper Maryland. By use of slow motion sections, interesting details of collection of pollen and other activities and behavior, practically beyond the grasp of ordinary vision, are clearly depicted. The public interest in a highly educational film of this type has already been indicated by the almost constant use that has been made of the beekeeping films put out by the Department nearly 10 years ago.

In the December number of the Monthly Letter reference was made to the isolation by C. E. Burnside, Somerset, Md., of an organism which appears to be closely related to Bacillus alvei Cheyne. Mr. Hambleton now reports that Mr. Sturtevant, from material submitted to him, has verified the results obtained by Mr. Burnside in that he was able, not only to differentiate the form in culture, but also to detect morphological differences and differences in staining quality. Therefore, it appears that there is little question that the organism is not the commonly encountered strain of Bacillus alvei.

E. L. Sechrist, Davis, Calif., made a trip in December to the Eldorado County fruit district, where he met, he says, "a number of fruit growers from whom data on fruit and pollination could be obtained, and plans formulated for completing the securing of such information. One grower in this territory has 400 Wickson plum trees. They have been in bearing age 4 to 5 years, never yielding over 125 boxes of fruit up to 1931. No trees of pollenizing varieties were present, with the exception of one Climax tree. The owner had always noticed that around this Climax tree he secured most of his plums. He grafted into the Wickson trees some Formosa plum scions. Nineteen hundred and thirty-one was the

first year these pollenizing grafts produced any blossoms. He also placed 10 colonies of bees in the orchard this year. The fruit marketed was 800 boxes. He intends to place twice as many colonies of bees in the orchard next year."

Mr. Sechrist states further: "The outstanding thing so far developing in this study is the limited areas in California in which rental of bees for pollination is practiced, or seems necessary. These areas can readily be supplied with bees while, in Oregon, and particularly in Washington, all the bees available in the State would not supply the needs of the fruit growers. In a number of fruit-growing sections of California the bees are either plentiful naturally, or are moved near the orchards by beekeepers because of scarcity of nectar elsewhere, so that the pollination is not apparent."

At the Somerset, Md., laboratory, according to Jas. I. Hambleton, "Work was continued on the determination of the per gallon weight of honey. The minimum weight of 12 pounds per gallon for honey has been considered for many years as the correct standard. In fact, the correctness of the figure has hardly been questioned. Recent studies made by G. E. Marvin and also by the University of Wisconsin indicate that there are a number of important commercial honeys produced in the United States which are lighter than 12 pounds to the gallon, and yet are excellent honeys, considered from the standpoint of ripeness, body, flavor, etc. In view of this fact, it will be desirable to specify a new minimum weight per gallon for honey in the revision of Circular 24, which describes the United States grades for honey. The study to date indicates that a weight of 11 pounds 12 ounces per gallon would not be too low. The specific gravity will be stated in pounds and ounces per gallon, with equivalent Baumé and Brix readings. In connection with the study of the specific gravity, an effort is also being made to work out an easy and accurate method which honey inspectors can use for readily detecting honeys that do not meet the minimum weight specifications."

FRUIT AND SHADE TREE INSECTS

A. J. Ackerman, Bentonville, Ark., reports that "The results of the 1931 control experiments indicated the necessity of combining oil and lead arsenate for efficient control of the codling moth (Carpocapsa pomonella L.) in this section. The white oils proved most promising. At the 1 per cent dosages in the first-brood cover sprays the oils showed ovicidal as well as larvicidal effectiveness. As little as one-fourth of 1 per cent oil in the late sprays provided an excellent spreader and sticker for protection of coverage in the late applications of lead arsenate."

Results of control investigations of the codling moth at Yakima, Wash., are reported by E. J. Newcomer, as follows: "Briefly, the results show that the use of oil emulsion with lead arsenate decreases the

quantity of wormy fruit; that the oil-nicotine combination is a valuable one; and that pyrethrum, in this case dissolved in oil, may be of some use in codling-moth control. Of the fluorine compounds tested, barium fluosilicate in the form used (Dutox) did not give especially good results either alone, with a spreader, or with fish oil. Potassium fluosilicate was better, as was the artificial cryolite. The natural cryolite and potassium flucaluminate, especially at 4 pounds to 100 gallons, were remarkably effective. Rotenone and cuprous cyanide gave poor control. The omission of the calyx spray resulted in a very high percentage of wormy apples."

E. A. McGregor, Lindsay, Calif., reports that "Nine types of sulphur were tested during the 1931 season as to their relative values for the protection of the oranges against injury from the citrus thrips (Scirtothrips citri Moult.). The data were secured by comparing the fruit damage in treated plats with the damage in the untreated check plats, present in every case. In this manner we were able to compute in terms of percentage the 'reduction in fruit-scarring.' For the several sulphur plats, the reduction in scarring was found to vary from 24.2 per cent to 94.2 per cent."

Concerning the gray citrus scale (Coccus pseudomagnoliarum Kuw.), Mr. McGregor states that the several insecticide programs--together with factors of natural control--have sufficed to keep in satisfactory condition most orchards where the scale population was fairly low at the beginning of the season. "The standard dusting program, as recommended by the Lindsay office, has kept most of the 'commercially clean' orchards commercially clean of the gray scale. * * * The check orchards have remained heavily infested."

A. W. Cressman, New Orleans, La., reports: "Another examination of the fig tree treated in October with paradichlorobenzene in cottonseed oil and painted with asphalt showed only two places which were infested with (three-lined fig-tree) borers (Ptychodes trilineatus L.) and one of these was on the underside of one limb, in a section which had evidently been missed in the treatment. One borer was found in an area which had been previously treated. These results indicate that when the above applications are made after scraping the bark of the infested branches, it may be possible to control the borer in moderately infested trees."

M. A. Yothers, Wenatchee, Wash., submits the following results obtained with various canker paints for preventing infestation by the woolly apple aphid (Eriosoma lanigerum Hausm.) on perennial canker (Gloeosporium perennans) of the apple: "(1) No paints applied as early as March, April, or May gave satisfactory woolly aphid control in cankers throughout the whole season; (2) several paints applied in June gave complete or nearly perfect control throughout the remainder of the season; (3) several other paints applied in August, upon cankers cleaned in July and August, gave satisfactory control throughout the remainder of the season; (4) some thirteen paints applied as repaints in July

over paints applied in March, April, and May, gave 100 per cent woolly aphid control throughout the remainder of the season; (5) each of the paints giving satisfactory woolly aphid control had nicotine sulphate incorporated in it; (6) woolly aphid colonization, particularly in cleaned but unpainted check cankers, became apparent early in May, by early June from 25 to 50 per cent of the checks were infested; (7) there seems to have been practically no change in the number of cankers infested after the mid-October examination."

"Inability to determine the sex of Conotrachelus nenuphar Herbst adults without dissection has handicapped certain phases of biological studies by workers at this and a number of other laboratories," writes Oliver I. Snapp, Fort Valley, Ga. "Therefore work was started (by Mr. Snapp and J. R. Thomson) during the month (December) to determine, if possible, a method by which the males and females could be distinguished accurately and easily without dissection. * * * The only noticeable differences in the external anatomy of the male and female found thus far is an enlarged tibial spur of the metathoracic leg of the male and a difference in the shape of the supra-anal plates."

A. C. Mason, of the Mediterranean fruit-fly project, Honolulu, T. H., submits a summary of the effect of elevation on the infestation of guavas by the fruit fly. He says: "By elevation here is meant all the environmental factors at the varying altitudes. Temperature, no doubt, is the most important single factor, but rainfall and other factors have an influence. * * * It will be noted that infestation varies from 68.7 per cent in fruits growing at less than 500 feet elevation to 28.1 per cent in fruits collected at 2,000 feet elevation. The percentage of infestation and also the average number of larvae per infested fruit decrease in direct proportion to the increase in elevation."

Mr. Mason and C. B. Keck recently inaugurated a series of feeding experiments at the Honolulu laboratory to determine the nature of the food fruit flies obtain from citrus, mango, and guava trees when no host fruits are present. "Adult flies have been maintained alive for 30 days in cages when given only leaves (changed daily) and distilled water. We have also shown that they can maintain themselves much longer when old, dirty, and sooty leaves are given them than when the leaves are fresh and clean. All the flies died in two days when the leaves were washed before being fed to them, giving the same results as for the checks, which were given water only. The data to date (December) indicate that the adult flies are living on honeydew excretions from scale and other insects on the trees. Since the citrus trees are well covered with these excretions and the resulting growth of sooty mold, this may account for the attraction of the flies to the citrus trees. Such a conclusion may offer an explanation as to why the flies remained in the citrus trees in Florida, resulting in the success of the poisoning campaign."

JAPANESE BEETLE AND ASIATIC BEETLE RESEARCH

M. H. Brunson, of the domestic parasite project, Moorestown, N.J., sums up the season's observations on Centeter cinerea Ald. as follows: "Beetles parasitized by Centeter cinerea were collected from 33 square miles of new territory, extending the area known to be occupied by the parasite to 179 square miles. Three thousand, one hundred and fifty-five parasitized beetles were collected in the field. Of this number 36.01 per cent were males, 62.99 per cent were females, 67.36 per cent of the parasites formed puparia, and 91.80 per cent of the eggs on the beetles hatched. About 13 per cent of the beetles were parasitized in locations where collections were attempted. Puparia were found in the greater part on top of the soil and in the first 2 inches. In propagation work, 10,858 parasitized beetles were obtained from 756 females. From this number of beetles 5,264 puparia were recovered, 50.15 per cent of the beetles formed puparia, and 63.68 per cent of the eggs on the beetles hatched. From 1,597 puparia propagated in 1930, 1,084 flies emerged and 67.87 per cent of the puparia formed flies."

A comparison of the quantitative data obtained by Henry Fox, Moorestown, in the seasonal surveys of the soil population of the larvae of the Japanese beetle as regards the larval movements in the soil, indicates three periods during which larvae ascend or descend: (1) An upward movement in the spring, (2) a slight downward movement in late spring or early summer preceding pupation, and (3) a more marked downward movement in the fall. Seasonal variations in these movements are indicated as conditioned by temperature. The depth to which the larvae descend for winter dormancy rarely exceeds 8 inches * * * Most of the larvae do not burrow deeper than from 3 to 6 inches, though very few remain above 2 inches. They evidently cease burrowing whenever the soil temperature at the level which they happen to have reached falls to 50° F. This latter fact, it may be added, has some bearing upon the possible future establishment of the Japanese beetle in the more northern sections of this country. If the larvae in these sections do not burrow deeper in the soil than do those in the latitude of central New Jersey, there is considerable probability that they will perish, as in severe winters soil temperatures, as far down as the larvae normally penetrate, fall at times below those which the available data indicate as 100 per cent fatal to Japanese beetle larvae.

I. M. Hawley has been making a study of the lateral migration of larvae of Popillia japonica Newm. in soil under greenhouse conditions. He describes the experiment as follows: "Four bins, each 4 feet square, were set up and filled with 12 to 15 inches of soil. In a trench across the middle of each bin, 100 grubs were placed at depths of 3 to 5 inches on October 27. The soil in the bins was kept moist and the soil temperature was normally between 65° and 75° F. The soil in the 4 bins was removed at intervals after 7 to 37 days had elapsed, at which time the lateral and vertical position of each grub was recorded. In general it may be said that some grub have shown a decided tendency to move from

the starting line, this tendency being rather small at the end of 7 days but so pronounced after 27 days that 21 of the 95 grubs recovered had travelled more than 16 inches, and 6 of them had reached the edge of the box, after travelling a distance of at least 24 inches. Grubs were found at every level from the top inch of soil to the bottom of the bin with a slight concentration at the 6 and 7 inch depths. The mortality was less than 1 per cent, in spite of the fact that no food was supplied."

M. R. Osburn, reporting on experiments in the control of Japanese beetle larvae with lead arsenate, says: "Generally speaking from the preliminary data there is not a consistent reduction of grubs at this time in plots receiving less than 10 pounds of lead arsenate to 1,000 square feet. Also, it seems that hydrated lime in combination with lead arsenate reduces the toxicity of lead arsenate to the grub."

TRUCK AND GARDEN CROP INSECTS

Reporting on vapor heat treatments of commercial stocks of bulbs, Randall Latta, Sumner, Wash., says: "Iris bulbs were treated at weekly intervals throughout the summer at a standard temperature of 111° F. for four hours. Samples were planted in flats and covered outside on October 12. The flats were uncovered and brought into the greenhouse (cool house) on December 21. The top growth of the different treatments showed marked variation and they were measured on December 28. * * * There is noted a marked difference in the effect of the treatments on the two varieties (Imperator and Yellow Queen). These figures (submitted) indicate particularly the effect of the treatment on the initial or starting growth. Generally a retardation is noted. In Imperator this retardation increases almost directly with the increase in the interval after digging. except for the one rise of the August 20 treatment lot. In Yellow Queen there is a wavering up and down, indicating a possible periodic function."

L. B. Reed, Chadbourn, N. C., summarizing a study of the strawberry root aphid (Aphis forbesi Weed), says: "Several months of observation in the same field seems to indicate that there is little relationship between foliage infestations and root infestations of A. forbesi, or between the foliage infestation of the aphid and the dying of plants. The data collected do indicate, however, that a heavy infestation of Lasius niger necniger (cornfield ant) in the spring is followed by a heavy infestation of A. forbesi on strawberry roots, a high mortality of plants during the dry season, and a corresponding decrease in the runner plant production during the fall and winter."

Charles E. Smith, Baton Rouge, La., gives additional data on the migration of the spotted cucumber beetle (Diabrotica 12-punctata Fab.). He says, "by the first of the month the beetle population had shifted very largely from the fall-flowering weeds to cultivated crops. On December 4 a migration flight was observed in progress a few miles south

of town. The flight originated on an old levee situated on the north side of a big bend in the Mississippi River with the beetles flying southward and directly across the river. During the flight the prevailing weather conditions were: Clear, temperature slightly above 60° F., and a rather stiff breeze from the north. On December 3 * * * the beetle population (in a chrysanthemum field at Arlington Farm, Va.) was (found by Norman Allen to be) greatly reduced, compared with that which prevailed on November 25."

The study by Dayton Stoner of the relation of the part that birds play in the control of the celery leaf-tier (Phlyctaenia rubigalis Guen. at Sanford, Fla., was mentioned in the November Monthly Letter. Mr. Stoner, reporting on the English sparrow, says: "The analyses of the stomachs of 61 adult birds collected in the Sanford celery district between November 29 and April 26 in the seasons of 1928 to 1930" show that 2.03 per cent of the food consisted of Lepidoptera (including 0.34 per cent celery leaf-tier); 1.05 per cent Orthoptera; 0.69 per cent miscellaneous insects (Coleoptera, 0.36 per cent; Diptera, 0.14 per cent; Hymenoptera, 0.03 per cent; others, 0.16 per cent); Araneina and other invertebrates, 0.86 per cent; vegetable material, 95.37 per cent. However, an analysis of the stomach contents of 22 nestling English sparrows shows that 49.03 per cent of the food of the young was of animal origin, insects alone comprising 48.5 per cent, and Lepidoptera alone making up 33.82 per cent.

W. A. Thomas, Chadbourn, N. C., reporting on the toxicity to mole crickets of lead-arsenate-treated soil, says: "In these experiments it was observed that cannibalistic tendencies develop after a period of approximately three weeks, where the insects are kept in soil treated with lead arsenate without the addition of food other than that normally found in sand. This tendency becomes so pronounced that in most cases it is impossible to continue the experiment until the insects have all died of poisoning." The mole crickets dead at the end of 23 days ranged from none to 90 per cent. He continues: "Under field conditions they may easily escape the treated soil by burrowing at a lower level. It has also been observed in these experiments that where the soil is allowed to dry until the capillary moisture is exhausted, the mole crickets die very quickly, seldom living under such conditions for as long as 24 hours."

From Rodney Cecil, Ventura, Calif., we have the following note on the seriousness of pod-borer injury: "A rancher in the vicinity of Ventura came to the laboratory recently for advice on control of the lima bean pod borer (Etiella zinckenella Treit.). His statement in regard to the injury from the pod borer agrees with our field observations. This rancher planted 200 acres of lima beans last spring. His costs records (not including rent of the land, labor, charges for plowing, planting, cultivating, or harvesting) were: For seed $300, threshing $370, and hand picking $221, or a total of $891. For this outlay he received $585 for 130 sacks of clean beans--a loss of $306.* * *

An average yield of beans from 200 acres would be 1,000 sacks. The loss of 870 sacks of beans was undoubtedly caused by the pod borer."

J. R. Douglass, Estancia, N. Mex., submits a summary of findings in a study of the hibernation of the Mexican bean beetle (Epilachna corrupta Muls.) in which he states: "Successful hibernation of the bean beetle in the Estancia Valley is confined to the western yellow pine (Pinus ponderosa Law.) association of the transitional life zone, especially where oak trees are associated. * * * The evidence at hand indicates that beetles could not hibernate above the Coloradan zone (7,000 to 8,500 feet) if adequate hibernation material was available. Evidence secured for several years shows that beetles could successfully hibernate below the Coloradan zone, if adequate hibernation material was available. The upper limits are determined by low temperature and moisture. * * * As the temperature decreases so do the moisture requirements for successful overwintering. * * * During hibernation seasons with cold wet springs a larger percentage of the beetles survives on the warmer slopes than on the northern slopes. On the eastern slope 4.91 per cent of the beetles survived in cage No. 7, as compared with 1.39 per cent survival in cage No. 5 on the northern slope. Again, on the southern slope, 11.54 per cent survived, as compared with 8.37 per cent survival in cage No. 10 on the northern slope. During warm, dry seasons a larger percentage of beetles survives on the northern slopes."

From observations on the tachinid Paradexodes epilachnae Ald., parasitic on the Mexican bean beetle, B. J. Landis, Columbus, Ohio, found that "of the (48) maggots (placed on moist soil) 57 per cent pupated at a depth of 1 inch or more below the surface. The greatest depth at which pupation occurred was 4 inches. Forty-six per cent pupated with the anterior end up; 25 per cent with the posterior end up, and 29 per cent were horizontal to the surface of the soil. * * * Of a cage of flies emerging in October, one individual lived 72 days. The stock from which this individual came had been bred in the laboratory since September, 1930."

C. F. Henderson, Twin Falls, Idaho, reports that from dissections of a large number of preserved beet leafhoppers (Eutettix tenellus Baker) collected in the summer the parasitism by pipunculid parasites ranges from none in sweepings made July 13, to 46.1 per cent in sweepings made September 11. Mr. Henderson says: "It is interesting to note the high percentage of parasitism of Agallia sp. by an unidentified stylopid for two points in the Hollister area on July 14, 1931 (50 and 61 per cent, respectively). Only one E. tenellus in over 100 individuals collected in the same sweeps with the Agallia sp. was found to be parasitized by a stylops."

R. E. Campbell and M. W. Stone, Alhambra, Calif., report an experiment "To determine the effect of applications of sulphur to the soil and to the larvae, pupae, and adults of (the wireworm) Pheletes californicus Mann." Following a description of details, the report says:

"It is apparent from this experiment that large applications of sulphur to soils is effective in bringing about a considerable lowering of the pH in proportion to the amount applied. The small number of larvae and adults recovered in the checks and heavily sulphur-treated cages may be due to the cannibalistic tendencies of larvae when large numbers are confined in a small area. These records show that 68.9 per cent of the surviving larvae of 1930 in the treated cages transformed to adults during the fall of 1931. Comparing this percentage of adult recovery with a 70.3 per cent recovery in 25 tile cages which have been examined this fall and which contained soil slightly alkaline, it is evident that an acid medium does not hasten or retard larval development . The fact that 21 per cent were able to survive in acid soil in tiles having an average pH of 4.01 and 3.62 and were subjected to a minimum pH of 2.8 and 1.8, respectively, for several months proves conclusively that even large amounts of sulphur are not toxic to any stage, including newly hatched larvae, nor does it prevent growth or pupation."

According to F. H. Shirck, Parma, Idaho, observations on the depth of winter hibernation of wireworms were made "by sifting in successive 2-inch layers the soil removed from a hole 16 inches wide by 3 feet long. * * * The top layer was frozen and had to be thawed out before sifting. No elaterids were found in it." It was found that 66 per cent of the larvae and all of the adults had hibernated at depths of 6 to 12 inches, and 33 per cent of the larvae at depths of 12 to 22 inches. The highest numbers of larvae were found at 8 to 12 inch depths where the soil moisture was as high as 7.6 per cent and the temperature ranged from 2° C. to zero.

FOREST INSECTS

F. P. Keen, Portland, Oreg., reports: "A 10-day meeting of the Forest Supervisors of the National Forests of Region 6 gave an opportunity of laying the problems of forest insect control before this conference for consideration. This is the first general meeting of supervisors that has been held for eight years. The Committee on Forest Management advocated the better training of the field men in matters of forest-insect control and the making available for them, in very brief form, information on the important insects. They recommended that this material be included in the Forest Management Manual. The committee, believing that the control of endemic infestation would prevent epidemics and the resulting heavy expenses for control, recommended that some experimental projects be started to determine whether such work was feasible."

On December 22 T. T. Terrell returned to the Coeur d'Alene, Idaho, laboratory, from the Shoshone National Forest where, in cooperation with Mr. Donery, logging engineer of Region 2, he has been engaged since

October 8 in control of the Douglas fir beetle (Dendroctonus pseudotsugae Hopk.). He says: "The costs of this project are indeed gratifying, as some 12,000 trees were treated at a cost of $0.77 per tree. This treatment entailed the felling of the infested trees and cutting the infested boles into logs, which were skidded into decks and burned."

A. L. Gibson, Coeur d'Alene, reports: "Data relative to the Beaverhead Insect Survey have been worked up, and show a tremendous increase in the number of lodgepole pine trees attacked by the mountain pine beetle (Dendroctonus monticolae Hopk.). The estimated loss during the 1931 season was in excess of 12,000,000 trees, while for the period from 1927 to 1931, inclusive, a total 18,500,000 trees have been destroyed. Losses on the northwestern part of the forest probably reached their maximum in 1931. Eastern and southern parts of the forest will probably show increasing destruction for a number of years. Diminishing food supply for the insects on the heavily infested parts of the forest should favor an increased migration of the mountain pine beetle from such areas. The results of this survey show quite definitely that insects are migrating from distant sources of infestation into areas on that portion of the Beaverhead previously considered as the Madison Forest."

K. A. Salman, Berkeley, Calif., reporting on regional survey studies of western bark beetles, says: "Brood records from both the Sierra and Modoc areas, where widely separated epidemics developed in 1931, have shown that the prolonged season resulted in the activity and attacks of the western pine beetle (Dendroctonus brevicomis Lec.) continuing until early in November. * * * about a month later than normal. * * * One striking difference in the insect population of the overwintering trees was uncovered by bole examinations after the trees were felled. In the Sierra area a high per cent of the infested trees were first attacked in the tops by the five-spined engraver beetle (Ips confusus Lec.). This topkilling, which usually extended downward for a distance of from 25 to 50 feet, was followed by the attack of the western pine beetle in the lower bole. In the Modoc areas, however, no infestation of the engraver beetle was found, but tops of many trees were killed by flathead borers, Melanophila spp. It is believed that this topkilling, by insects normally secondary to Dendroctonus in their attack, is mainly due to the weakening of the trees in the late summer by the prolonged dry season of 1931."

"Results of the Devil's Garden experiment (Modoc National Forest), where for the past three years an effort has been made to exterminate completely the western pine beetle on a small isolated area of western yellow pine, were worked up during the month by K. A. Salman and P. C. Johnson," states J. M. Miller, Berkeley, Calif. "These preliminary results indicate that the work was not successful in exterminating the beetle, * * * However, the infestation of flathead borers (Melanophila)

has increased, and the volume of timber killed in 1930 (over 50,000 feet b. m.) was greater than that for any other year since the area was first cruised in 1927. The winter brood for 1930 showed 52 per cent of the bark surface infested by flathead borers and only 28 per cent by the western pine beetle- a distinct reversal of conditions found at the inception of control work in 1928-29."

R. C. Brown, of the gipsy moth laboratory, Melrose Highlands, Mass., reports as follows concerning observations made on a trip to a village in the township of Dighton, Mass.: "Several large elms in the churchyard and nearby were heavily infested by the elm leaf beetle (Galerucella xanthomelaena Schrank) last summer. According to the inhabitants of the village great numbers of the beetles invaded the houses and church in the fall in search of hibernation quarters. Large numbers were swept up and destroyed in the church and upper rooms of the houses.* * * * On December 2, 1931, a careful search was made in near-by stone walls and under débris piled near the church, and a large number of dried leaves were examined, but not a single hibernating beetle was found. These observations and others made last fall lead to the conclusion that the number of beetles which hibernate outside of buildings is practically negligible. This suggests the possibility of contriving some type of a beetle trap which might be employed to catch the beetles as they enter or leave buildings."

J. A. Millar, Melrose Highlands, submits "figures relative to the extent to which collections of gipsy moth egg clusters, taken last fall by members of the staff at various points in New England, were parasitized by Anastatus disparis Ruschke and Ooencyrtus kuvanae How. Mr. Millar's data show that the parasitism by A. disparis ranged from 1.8 to 22.79 per cent (being lower than for last season) and that the parasitism by O. kuvanae ranged from nothing to 0.69 per cent.

C. E. Hood, who has been conducting spraying experiments against the beech scale (Cryptococcus fagi Bar.), reports that practically 100 per cent kill has resulted from spraying (on November 10) with 7 and 5 per cent solutions of miscible oil. Mr. Hood says that in December "On the check trees the scales appear healthy, are a golden yellow in color, and a large percentage of them are living."

F. W. Sellers, Budapest, Hungary, says: "Dissections of larvae of the larch case bearer (Haploptilia laricella Hbn.) collected in Austria have shown parasitism by what appear to be three species. Two of these are perhaps braconids, and the other a chalcid. A collection of larvae made at Kamel yielded the most parasites. Fifty were secured from 180 larvae."

CEREAL AND FORAGE INSECTS

Correction: The species of Microbracon reared by H. R. Painter from Phytonomus nigrirostris Fab. collected at Roanoke, Ind., as reported on p. 19 of the October Monthly Letter, was M. tenuiceps Mues. and not M. tachypteri Mues.

F. F. Dicke, Charlottesville, Va., reporting on investigations of the wheat joint worm, says: "Observations on oviposition by Harmolita tritici Fitch indicate that in practically all instances there is a decided preference shown for certain culms. Also a certain node in these plants is preferred above all others in which to deposit their eggs. The point chosen for oviposition is usually immediately below the developing flower cluster. Portions of infested culms were fixed shortly after oviposition and prepared for sectioning. A study of these sections shows that all of the eggs are placed at practically the same plane immediately above the node."

C. C. Wilson, Sacramento, Calif., submits data giving "the present status of the more abundant species (of insects) present in alfalfa, as determined by the 50-sweep method of observation." The insects are Illinoia pisi (Kalt.), Agallia sanguinolenta Prov., Lygus pratensis L., and Diabrotica soror Lec. From the data obtained Mr. Wilson concludes that "the insects overwintering in the adult stage apparently prefer alfalfa that is tall with dense growth to alfalfa that is short, affording little protection. A cultural method of insect control may be indicated here."

Mr. Wilson notes that the field cricket (Gryllus assimilis Fab.) "is overwintering in the third instar to adult under leaves and in cracks in the soil. Crickets under laboratory conditions range from the third instar to adult. One adult male has lived 122 days."

Reporting on biological studies of Anastatus semiflavidus Gahan, a parasite of the range caterpillar (Hemileuca oliviae Ckll.), J. C. Frankenfeld, Tempe, Ariz., says, "efforts to study the development of Anastatus semiflavidus have been greatly aided by finding that parasite eggs dissected and kept in a physiological salt solution will develop normally and hatch." Concerning these studies V. L. Wildermuth says, "in reporting percentage of parasitism in the colony rearing cages this has in the past been accomplished by counting the number of egg punctures in a given number of eggs, taking it for granted that each egg showing puncture was parasitized. In order to check up on the percentage of these punctured eggs that actually showed parasitism six different tests showing 655 punctured eggs of H. oliviae were carried through to completion by O. L. Barnes. It was found that 92.8 per cent of the host eggs showing punctures were actually parasitized."

On December 5 a conference was held in Sioux City, Iowa, to discuss the grasshopper situation. This conference was attended by W. H. Larrimer and J. R. Parker, of the Bureau, and by entomologists from seven of the States. The results of the survey conducted by the Bureau in cooperation with the States were fully considered. Details of the plan to combat the probable unusual abundance of grasshoppers over some of the western States were outlined. The State workers emphasized the necessi-

ty of Federal aid in areas which had been severely hit by the drought and other conditions during the past two seasons. It was agreed that if such aid were made available Federal funds would be used to purchase poison bran bait for delivery to designated parties within such counties. After such delivery the county and State organizations were to delegate local organizations for spreading the bait. No bait was to be furnished to individual farmers, but to community organizations under appropriate community leaders. It was also agreed that baits were to be furnished only to the counties not able to finance grasshopper control campaigns.

COTTON INSECTS

K. P. Ewing, assisted by W. S. Cook and R. L. McGarr, have continued making population counts of the tarnished plant bug (Lygus pratensis L.) at Tallulah, La. They report: "Although Lygus pratensis was not as active during December as in November it could still be collected in fairly large numbers on green plants, especially alfalfa. It could also be collected from the dormant stems or foliage of their previous preferred weed host plants, as Aster, Erigeron, and goldenrod." The average numbers per 100 sweeps of L. pratensis collected for four weeks in December (from an average of 200 sweeps per host plant each week) were: From alfalfa, 96.0, 77.7, 76.8, 83.7; from Aster ericoides, 75.0, 79.8, 34.0, 15.0; from Erigeron canadensis, 13.0, 18.0, 0.0, 0.0; from goldenrod, 39.5, 26.5, 61, 42.5. No living specimens of the cotton flea hopper (Psallus seriatus Reut.) or the cotton plant bug (Adelphocoris rapidus Say) were collected.

Summing up from reports of various observers at Tallulah, La., the unusually high temperatures prevailing during the fall months evidently caused notable variation in the normal type of hibernation of the boll weevil. Most fields in northern Louisiana had been defoliated by killing frosts from October 31 to November 2, but following that period mild or even warm weather prevailed, with the temperature never less than 30°. The October-November cold snap resulted in migration of practically all of the weevils to the few fields protected by proximity to the river or lakes. The regular fall moss examinations for weevils were made December 2 to 5, when it was believed that weevil migration to hibernation quarters had been completed. However, "on December 14 32 weevils were collected from the 26 field screens, which is considered a good catch during the summer months. These figures show that weevils were in the fields or that weevils were returning from hibernation quarters to some fields of old cotton which were sprouting a new and succulent growth." The total so collected for the month was 89 weevils, the high points being 20 weevils on the 12th and 32 on the 14th. Twenty-seven weevils, fairly uniformly distributed, were collected between the 20th and the 30th of the month. To determine the amount of each movement, population counts were made, resulting in the collection of 113 weevils from 0.07 of an acre at Mound, La. (equalling 1,614 weevils per acre); 320 weevils from 0.18 of an acre at Lake Providence (equivalent to 1,778 weevils per acre).

"On both fields we were able to find cotton blossoms, numerous squares, and green bolls. Many squares showed typical egg punctures and young larvae and, no doubt, some larvae were maturing and emerging. There were also live pupae of the cotton leaf worm and one live moth was collected. Live adults of Lygus pratensis, Lygus apicalis, Graphocephala, Stictocephala, and Diabrotica 12-punctata were numerous. *** Warm and rainy weather continued throughout the month of December and weevils were taken from the field screen traps during the last week of December."

E. W. Dunnam, College Station, Tex., reporting on the behavior of boll weevils when placed in hibernation cages with different types of shelter, notes that they showed greater promptness or readiness to go into the shelter containing Spanish moss. Cornstalks came next in this particular, and leaves seemed to be least attractive at the outset. "This, no doubt, was on account of the leaves being located much nearer the ground and * * * holding more moisture. * * * It should be remembered that there has been no killing frost at this writing (December). On unusually warm days weevils were crawling on the sides of the cages, while on cool days they were quietly resting on the sides of the cages."

F. A. Fenton submits a resume of cultural control experiments on the pink bollworm (Pectinophora gossypiella Saund.) in 1930-31 by D. A. Isler and A. J. Chapman, jr., at Presidio, Tex. One of the important points brought out is the effect of the depth of plowing in the 6 plots in this series. In the plots which were not irrigated, the lowest survival resulted from 6-inch plowing, although survival was not much greater from the 8-inch plowing. The 4-inch plowing, however, caused a very high survival. When the plots were irrigated immediately following plowing no survival was recorded from 8-inch plowing, and survival was relatively low and the same from the 4-inch and the 6-inch plowings."

A. J. Chapman, jr., and L. W. Noble, Presidio, report that "The (pink boll worm) moth catch on the screens this year was considerably heavier than recorded for any previous year. The seasonal catch for all the screens was 631 moths. * * * The catch according to months was as follows: September, 3; October, 226; November, 388; and December, 13. The last observation was made December 4. * * * Twenty-eight moths were caught in the trap facing up-wind, as compared to 13 facing down-wind. This indicated that most of the moths travel with surface winds. The average catch per screen from 1928 to 1931 was as follows: 1928, 3; 1929, 1.8; 1930, 9.7; 1931, 111.3."

A. J. Chapman, jr., and H. S. Cavitt report the results of a series of experiments at Presidio, beginning December, 1930, to determine the relation of soil type and soil moisture to the emergence of pink boll worm moths from overwintering larvae in cotton bolls buried in the soil. These tests were made in 2-gallon earthenware crocks, in each of which were placed 25 infested cotton bolls with an average of 3.94

larvae per boll. In the four series of experiments, comprising 40 tests in 160 crocks, more than 15,000 larvae were used. The results indicated: (1) Emergence of moths was greater from the sandy soil from Germania, Tex., than from any of the other seven types of Arizona and Texas soils used in these tests; (2) saturating the soil with water reduced survival (4.7 per cent of the larvae emerged as moths from the soil that was saturated in December, while 16.2 per cent emerged from the soil that was not saturated); (3) no moths emerged from soil kept constantly saturated with water; (4) emergence of moths was very slight when bolls were buried in dry soil; (5) emergence of moths increased with per cent of moisture present in the soil up to 19 per cent water in sandy soil and 24 per cent water in adobe soil.

INSECTS AFFECTING MAN AND ANIMALS

John B. Hull, of the Charleston, S. C., laboratory, found that at Jacksonville, Fla., "the shady conditions on the edges of the marshes were as favorable (as breeding places) for sand-fly larvae as those found in the vicinity of Charleston." Mr. Hull ran his isolation units in the laboratory of Dr. Eaton, of the Florida State Board of Health. "This cooperation enabled us," says W. E. Dove, "to use our experiments as demonstrations. The units were in operation during the meeting of the Florida Health Workers. The health officers, sanitary workers, and others had an opportunity to learn of our work."

Roy Melvin, of the Galesburg, Ill., laboratory, reports that at Lamar, Colo., "Observations have been in progress on the total developmental period of (cattle grubs) Hypoderma lineatum De V. in the backs of cattle. The shortest total period observed was 33 days and the longest so far observed was 58 days."

Deed C. Thurman and S. M. Perry, concerned with trapping of blowflies at Dallas and Menard, Tex., report: "The total catch of all species of blowflies taken in the trapped area during the trapping period of 1931 (March 1 to December 1) amounted to 18,937.6 quarts of flies."

D. C. Parman, Uvalde, Tex., reporting on blowfly larval migrations from carcasses to enter soil for pupation, states: "It has been found that the larvae tend to cluster more during the cold, wet weather, and do not migrate to any extent. The clumps break during warmer days, and there is a tendency for the larvae to enter the soil for pupation. No larvae have been found at a greater depth than 6 inches in loose soil, and in the heavy clay soil the larvae tend to migrate to greater distances and pupate from 1 to 2 inches beneath the surface of the soil. The purpose of these studies is to find a method that might be used in caging larvae and pupae under natural conditions for spring emergence in order that further data on hibernation of flies, parasites, and predators might be obtained."

O. G. Babcock, Sonora, Tex., reports further on experiments in the control of goat lice: "On November 10, 1931, 472 head of lousy goats at the Texas Experiment Station were dipped in 300-mesh wettable sulphur at a dilution of 10 pounds of sulphur to 100 gallons of water, at a temperature of 64.4°F. All goats were ducked at least four times and held in the vat for a minimum of one-half minute. On the twentieth day * * * the lousy goats, previously marked, showed that one-half * * * were lousy, while the other half were free of lice. Thirty one days following the second dipping more than 50 head were examined for lice; only 2 live and active biting lice were found, one each on 2 goats. The sulphur was still present in the mohair, but the mohair had grown about three-fourths of an inch."